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ABSTRACT

Changes in student perceptions over the first year of high school form the basis of this study. Self- and task-perceptions, as well as affect and utility judgments, are measured in relation to English and mathematics, since the transition to high school has been found to impact negatively on students' self-concept in these domains. The impact of gender and level of academic achievement on the nature of changes in students perceptions is also measured. Participants (N=365) are from 3 coeducational Government schools in metropolitan Sydney (Australia) of comparable socioeconomic status. Analyses to determine changes in perception and performance are analyses of variance with repeated measures. Major implications derived relate to domain specificity and the stability or instability of varying perceptions over time for particular subgroups of students with respect to their academic achievement and gender. (Contains 2 tables, 16 figures, and 42 references.) (Author/SLD)

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Measuring Attitudinal Change in Mathematics and English over the First Year at High School: A Multidimensional Analysis

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Changes in student perceptions over the first year of high school form the basis of this study. Self- and task-perceptions as well as affect and utility judgements are measured in relation to English and mathematics, since the transition to high school has been found to impact negatively on students' self-concept in these domains. The impact of gender and level of academic achievement on the nature of changes in student perceptions is also measured. Participants (N=365) are from three coeducational Government schools in metropolitan Sydney of comparable socioeconomic status. Analyses to determine change in perception and performance are ANOVAs with repeated measures. Major implications derived relate to domain specificity and the stability or instability of varying perceptions over time for particular subgroups of students with respect to their academic achievement and gender.

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I am grateful for the guidance of my PhD main supervisor, Dr Ray Debus from The University of Sydney, in the preparation of this manuscript. My methodological supervisor, Dr Mike Bailey, formerly of The University of Sydney also contributed to decisions about analyses employed.

There is a growing body of research into the effects on students of the transition from primary to secondary school. These studies have addressed a range of student-level variables including self-esteem (eg: Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Simmons, Blyth, Van Cleave, & Bush, 1979), self-concept of ability (eg: Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991), perceptions of competence (eg: Harter, Whitesell, & Kowalski, 1992), liking for school subjects (eg: Wigfield *et al.*, 1991), and school grades (eg: Anderman & Midgley, 1997; Kavrell & Petersen, 1984). The majority of these studies have found the overall impact of transition to secondary school to be negative in nature, leading to decreased self-esteem (Seidman *et al.*, 1994), lower self-concept of ability in specific school subject domains (Wigfield *et al.*, 1991), declines in perceptions of competence (Anderman & Midgley, 1997), decreased liking in specific school subject domains (Wigfield *et al.*, 1991), and lowered school grades (Anderman & Midgley, 1997).

Some theorists have suggested that such negative changes are inevitable due to physiological and psychological pubertal changes occurring at this time (eg: Blyth, Simmons, & Carlton-Ford, 1983; Hill & Lynch, 1983; Rosenberg, 1986; Simmons *et al.*, 1979). This view has been challenged by research showing that declines in students' expectancies and values in mathematics relate to differences in the classroom environment pre- and post-transition (Eccles & Midgley, 1989; 1990). These analyses have been interpreted in the form of a model of person-environment fit (Eccles & Midgley, 1989; 1990), in which it is suggested that lack of fit between the secondary school environment and the needs of young adolescents impacts negatively on student attitudes. The present study is located within this theoretical perspective and seeks contextual explanations for negative changes in student perceptions where these occur.

Domain Specificity

The importance of assessing transitional impact on separate school subject domains has been recognised since not all domain-related perceptions are affected in the same way (eg: Wigfield *et al.*, 1991), and domain-specific findings differ from general student perceptions. For example, Harter (1982) found general perceptions of competence to be stable from grades 3 to 9. Clearly these general measures mask domain-specific changes over this time period.

The present study examines the effects of the first year at high school on students' perceptions and performance in relation to English and mathematics, since these are domains in which transition has been found to impact negatively on students' self-concept (eg: Wigfield *et al.*, 1991). Mathematics is also a domain which is regarded as being of substantive importance, since students' mathematics-related attitudes impact strongly on school mathematics course selections (eg: Eccles & Jacobs, 1986; Watt & Bornholt, 1994) and mathematical career relatedness (Watt, 1995), participation in both of which is considered socially important. It is a focus of the present study also to identify patterns which are domain specific, in that they hold for English but not mathematics and vice versa.

Important Subgroups

It cannot be assumed that all students will be affected similarly by the transition to high school. Gender and ability have been identified at two salient dimensions along which to examine group differences (Anderman & Midgley, 1997). It has been found for instance, that boys on average have more positive attitudes and self-perceptions than girls in mathematics (Eccles, Adler, & Meece, 1984; Marsh, 1989; Wigfield *et al.*, 1991), and conversely for English (Wigfield *et al.*, 1991). It has been suggested that such gender differences may be artifactual effects produced by a response bias (Wigfield *et al.*, 1991), wherein boys tend to be more self-congratulatory than girls on self-report

measures (Maehr & Nicholls, 1980; Bornholt, Goodnow, & Cooney, 1994). An earlier study by the author (Watt, 1996) suggests this may not be the case in mathematics however, since boys scored higher than girls on both their ipsative judgements of mathematical talent (i.e. relative to each of their other school subjects) and also on traditional rating measures of their talent at mathematics. Also, this notion is inconsistent with girls rating their English talent higher than boys (eg Wigfield *et al.*, 1991). There is some research to suggest gender intensification occurs (Hill & Lynch, 1983), wherein gender-role activities become more important to young adolescents as they try to conform more to behavioural gender-role stereotypes (Eccles, 1987; Hill & Lynch, 1983). Thus, girls become more negative about male-stereotyped domains, for example mathematics, while boys become more positive, and conversely for female-stereotyped domains such as English. Not all research has found this to be the case (eg: Wigfield *et al.*, 1991). For mathematics, discrepant findings have been explained by suggesting mathematics is no longer perceived as a male domain.

Measured ability in the domain, or more accurately actual prior performance, has also been identified as a determinant of attitudinal adjustment to the high-school setting. One study found high-mathematics-performing students' self-concept to be the most affected by the transition, with lower achieving students' self-concept actually increasing post-transition (Wigfield *et al.*, 1991). This study found no corresponding interaction effects for English, however (Wigfield *et al.*, 1991). It seems likely that the streaming or ability-grouping that occurs in high-school leads to homogeneous reference comparison groups, such that high-achieving students no longer outperform the majority of their classmates, and conversely low-performing students no longer perform relatively poorly. This may result in students' self-perceptions becoming more homogeneous, as high-ability students' perceptions become less positive, and low-ability students' less negative (Wigfield *et al.*, 1991).

Student Beliefs

Most studies of domain-specific student beliefs have examined perceptions of ability for different activities (eg: Cauce, 1987; Harter, 1982), with one study including subject liking as a value-indicator in addition to perceived ability (Wigfield *et al.*, 1991). The present study examines self-perceptions (perceived talent, expected success and effort exerted), task-perceptions (perceived difficulty and effort required), affect (liking or interest) and utility-value (perceived usefulness) in relation to English and mathematics, to see whether the first year of high school, gender, level of achievement and/or any interactions among these produce differential changes for various student perceptions, and whether these are context bound in terms of domain specificity.

Student Performance

The transition to high-school has been found to result in a decline in school grades. However, this decline has not been accompanied by decreased achievement on standardised achievement tests (Kavrell & Petersen, 1984; Schulenberg, Asp, & Petersen, 1984). Lowered school performance may be gender-related, since one study found a moderate correlation (r=.44) between boys' pre- and post-transition school mathematics grades, but no significant relation for girls (Anderman & Midgley, 1997). It is noteworthy that the same study found strong correlations for both boys (r=.77) and girls (r=.81) on standardised mathematics basic skills tests. It is possible then that changes in school grades may reflect new assessment procedures rather than a real drop in student performance.

The Present Study

The present study examines changes in students' English- and mathematics-related perceptions over the course of the first year at high school. Although this is not strictly a test of the impact of the transition to high school, since students are assessed at the very beginning (i.e. post-transition) and the very end of Year 7, the study does capture changes that occur over this year. There is a major advantage to this design, in that the problem of confounding change in school setting with change in grade level is circumvented (Anderman & Midgley, 1997; Harter, Whitesell, & Kowalski, 1992). Also, since it has been suggested that motivational perceptions may stabilise soon after the beginning of the new school year (Deci, Schwartz, Sheinman, & Ryan, 1981), changes within the first year of high school warrant investigation. The study by Wigfield and colleagues (Wigfield *et al.*, 1991) does this, having two waves of data collection in each of grades 6 and 7, but investigates only perceived competence and liking in relation to mathematics and English.

Frequently researched perceptions of competence are included in this study, but assessed by more narrowly defined perceptions of perceived talent, expected success and perceived difficulty. More recently, research addressing liking as a value indicator is addressed in the form of affect, items of which include liking, enjoyment and interest. Other measures in this study are effort exerted, effort required and utility judgements. It was expected that changes would overall be negative where they occur, that boys would have more positive mathematics-related and girls more positive English-related perceptions, and that high-achieving students would have more positive perceptions than lower achieving students. Moreover, it was anticipated that high-achievers would be most negatively affected over the year (as an achievement x time interaction effect would indicate), and that girls may be more negatively affected than boys in relation to mathematics, and conversely for English (as would be indicated by a gender x time interaction effect). Changes in students' English and mathematics performance are also of interest.

METHOD

Design

The study aimed to investigate the nature and extent of changes in student self-, task-, affect and utility-related perceptions in relation to high school English and mathematics, as well as English and mathematics performance over the course of the first year at high school. Whether student gender and level of achievement interacted with time effects or exerted independent effects on student perceptions and performance were also foci of the study.

Participants

Participants were Year 7 students (N=365) from three government coeducational schools in an upper-middle class metropolitan area of Sydney of comparable socioeconomic status (ABS Index for Education and Occupation, 1995). Distribution of students by school and gender is shown in Table 1. None of these schools streamed students at the beginning of the year, although School 3 streamed their Year 7 students halfway through the year (after the mid-year examinations) into each of a top, middle and bottom class for each subject setting.

Materials

Questionnaires assessed student perceptions in relation to English and mathematics at high school. Measures were developed for student self-perceptions (perceived talent, expected success, effort exerted), task-perceptions (perceived difficulty, effort required), affect (interest) and utility

judgements (perceived usefulness) for both mathematics and English. These items were measured on 7-point Likert-type scales anchored at both ends, and formed part of a much larger study investigating a broader range of student perceptions and related influences in relation to both mathematics and English, which are not the focus of the present study. Students also completed standardised mathematics and English tests at both time points, to obtain measures of student performance.

Table 1
Distribution of Students by School and Gender

	School 1	School 2	School 3
Boys (n=210)	74	103	33
Girls (n=155)	67	61	27
Totals (N=365)	141	164	60

Student Perceptions. Confirmatory factor analyses using LISREL confirmed which questionnaire items best defined each of the seven constructs under investigation for English and mathematics, and eliminated items with high cross-loadings. One-factor congeneric models were then used to determine the relative contributions of items to each construct, and create composite variables for each.[1] The result is high construct validity for each variable in both administrations (T1 and T2) as shown in Table 2.

Performance. Students' academic performance in mathematics was measured on standardised Progressive Achievement Tests (ACER, 1984). Alternate items were chosen so that each test could be administered along with the questionnaire in a 60-minute lesson. Internal consistency for the February test (PAT 2A) was Cronbach alpha .83, and for the December test (PAT 3B) was .75, indicating that both versions of the mathematics tests were reliable. Test performances were equated via Rasch modelling statistics normed on a representative Australian sample[2] (ACER, 1984), enabling comparisons of student performance at the beginning and end of Year 7.

Students' English performance was assessed using the Tests of Reading Comprehension (TORCH) also developed by ACER (Mossenson, Hill, & Masters, 1987). Forms 'A Horse of Her Own' and 'Iceberg Towing' were used in February and December respectively. Again, equating was possible via Rasch modelling statistics normed on students in Years 3 to 10 in Government schools in Western Australia in 1984 (Mossenson, Hill, & Masters, 1995).

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[1] The items for each of mathematics and English are exactly comparable, consisting of the same wording except the replacement of the word 'English' with 'mathematics'. A criterion in scale refinement was that latent constructs for both English and mathematics should comprise the same items to enable direct comparison of these constructs across academic domains.

[2] The Rasch-scaled PATMATHS Scale scores express student attainment on any of the tests in the series on an achievement scale which relates attainment to the difficulties of the items using the same units and the same scale for both measures (ACER, 1984, p. 7).

Table 2
Construct Validity of Mathematics and English Variables[a]

		mathematics	English
Perceived Talent	T1	R=.930,[b] $\chi^2_{(3)}$=.06[c] p=.997[d]	R=.924, $\chi^2_{(3)}$=.07 p=.995
	T2	R=.917, $\chi^2_{(3)}$=.01 p=1.000	R=.909, $\chi^2_{(3)}$=.02 p=1.000
Expected Success	T1	R=.913, $\chi^2_{(3)}$=.02 p=1.000	R=.901, $\chi^2_{(3)}$=.03 p=.999
	T2	R=.921, $\chi^2_{(3)}$=.06 p=.996	R=.900, $\chi^2_{(3)}$=.03 p=.998
Perceived Difficulty	T1	R=.958, $\chi^2_{(3)}$=.02 p=1.000	R=.918, $\chi^2_{(3)}$=.02 p=.999
	T2	R=.892, $\chi^2_{(3)}$=.04 p=.998	R=.899, $\chi^2_{(3)}$=.03 p=.999
Interest	T1	R=.959, $\chi^2_{(3)}$=.02 p=.999	R=.940, $\chi^2_{(3)}$=.09 p=.994
	T2	R=.951, $\chi^2_{(3)}$=.28 p=.965	R=.969, $\chi^2_{(3)}$=.11 p=.991
Perceived Usefulness	T1	R=.932, $\chi^2_{(3)}$=.05 p=.997	R=.890, $\chi^2_{(3)}$=.00 p=1.000
	T2	R=.929, $\chi^2_{(3)}$=.07 p=.996	R=.936, $\chi^2_{(3)}$=.07 p=.996

Procedure

Students completed questionnaires asking about their perceptions in relation to English and mathematics at high school, and also completed standardised English and mathematics tests. This procedure was carried out at the beginning of the school year (February 1996) and repeated at the end of the school year (December 1996). This circumvented the problem identified by Harter and colleagues of confounding change in school setting with change in grade level (Harter, Whitesell, & Kowalski, 1992).

The study was conducted with informed student and parent consent, and the approval of the School Principals and formal University and Departmental ethical bodies. Administration was in the regular classroom to maximise ecological validity. The researcher was present at each administration to clarify or answer questions where necessary. Administration at each time point was spread over two days, the first for mathematics tasks and second for English, in order not to overburden respondents.

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[a] Note. These statistics could not be computed for effort exerted and effort required, since one item had to be discarded from the former due to its large associated error of measurement resulting in a 2-item scale, and the latter consisted of only 2 items to begin with.

[b] Note. 'R' indicates the coefficient of determination for the x-variables, equivalent in this case to the true scale reliability.

[c] Note. The chi-square to degrees of freedom ratio provides a measure of the goodness of fit of the model. All ratios in this case are very small, indicating excellent fit.

[d] Note. The p-value denotes the probability of departure of data from the fitted model. All p-values here are well over .95, indicating excellent fit of the model to the data.

Analyses

After forming valid and reliable composite variables for each of the student perceptions, repeated-measures ANOVAs with time as the within-subject and gender and performance level as between-subjects factors enabled detection of change in student perceptions and performance over time, as well as gender and achievement-level effects and interaction effects of time, gender and level of achievement. Level of achievement was determined according to initial performance on each of the standardised English and mathematics tests, with the highest-performing third of students forming one group, the middle third forming a second group, and the lowest-performing third forming the last group in each case.

RESULTS

Results are presented in six main sections. The first examines effects on students' English and mathematics performance. The second to fifth sections describe effects on students' self-, task-, affect and utility related perceptions for both mathematics and English. The final section reports domain differences between students' mathematics and English related perceptions.

Effects on Student Achievement

Mathematics. There was a small but highly significant increase in student mathematical achievement across Year 7 ($F(1,310)=38.84$ $p<.001$, T1 mean=54.15 s.d.=5.11, T2 mean=55.20 s.d.=4.19), as determined by Rasch scaled scores for the two standardised achievement tests (ACER, 1984). There was also a main effect of initial mathematical level of achievement ($F(2,310)=337.42$ $p<.001$), with initially high, middle and low level achieving students maintaining this rank order at T2 for both girls and boys (Tukey's HSD). There was, however, a highly significant interaction effect of achievement and time, with initially low-achieving students exhibiting the greatest gains in mathematical performance ($F(1,90)=169.64$ $p<.001$), followed by middle-achieving students ($F(1,108)=7.41$ $p=.008$), and initially high-achieving students actually exhibiting a minimal drop ($F(1,112)=17.3$ $p<.001$; see Figure 1). There was also a significant interaction of achievement and gender ($F(2,310)=3.33$ $p=.037$), accounted for by the fact that high-achieving girls had slightly lower performance than their male counterparts ($F(1,112)=4.62$ $p=.034$; see Figure 1).

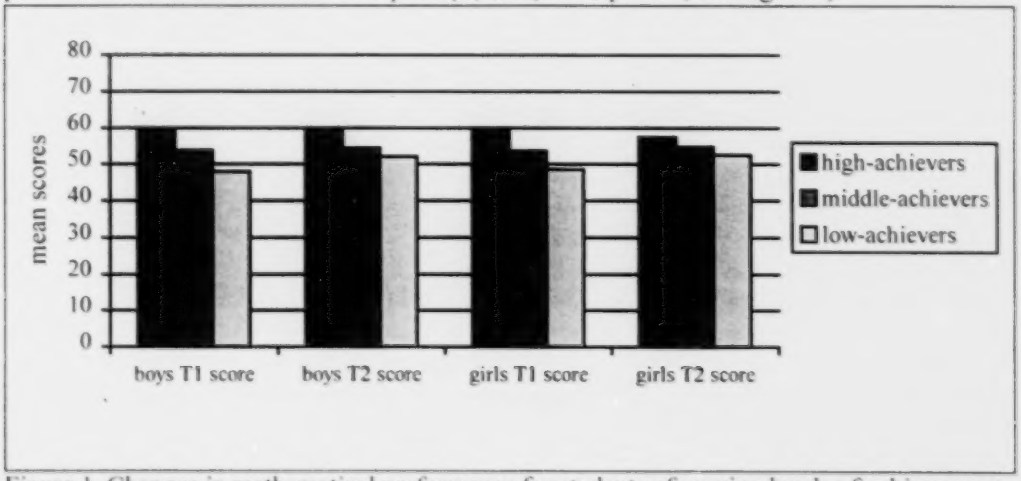

Figure 1. Changes in mathematical performance for students of varying levels of achievement.

English. There was also a highly significant improvement in students' English performance as measured by the Rasch-scaled TORCH test results ($F(1,320)=205.94$ $p<.001$, T1 mean=46.84 s.d.=15.54, T2 mean=53.98 s.d.=11.55). There was also a main effect of initial level of English achievement ($F(2,320)=286.57$ $p<.001$) with students of initially high, middle and low achievement maintaining this order at the end of Year 7 (Tukey's HSD). As for mathematics, there was an interaction effect of achievement-level and time ($F(2,320)=64.57$ $p<.001$), again with initially low achieving students exhibiting the greatest gains in performance ($F(1,106)=157.62$ $p<.001$), followed by middle-achievers ($F(1,97)=81.02$ $p<.001$), with high-achievers maintaining a similar level of achievement over the year ($F(1,117)=1.30$ $p=.26$). There was also a significant, if small effect of gender on English achievement, with girls consistently outperforming boys by a small margin ($F(1,320)=3.97$ $p=.047$, boys' T1 mean=45.04, girls' T1 mean=47.03, boys' T2 mean=53.33, girls' T2 mean=54.66). Figure 2 represents students' English performance from the beginning to the end of the year separately for boys and girls of varying levels of initial achievement.

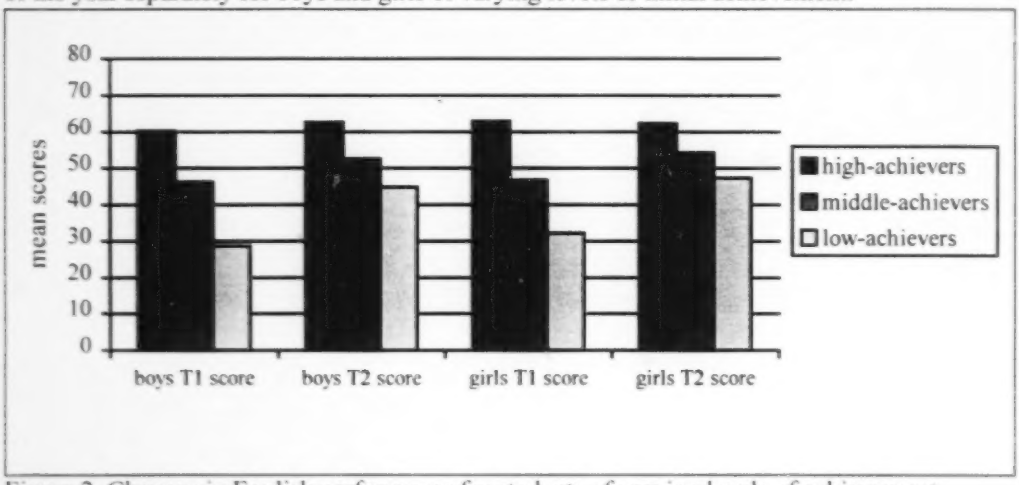

Figure 2. Changes in English performance for students of varying levels of achievement.

Student Self-Perceptions

Mathematics. Students' perceptions of talent in relation to mathematics were consistently higher for boys ($F(1,286)=6.58$ $p=.011$, boys' T1 mean=4.75 s.d.=1.23, boys' T2 mean=4.63 s.d.=1.31, girls' T1 mean=4.45 s.d.=1.02, girls' T2 mean=4.43 s.d.=1.19). There was also an interaction effect of achievement-level and time ($F(2,286)=5.58$ $p=.004$), whereby perception of mathematical talent decreased significantly for students initially having the lowest mathematical performance ($F(1,76)=8.19$ $p=.005$, T1 mean=4.13 s.d.=1.20, T2 mean=3.82 s.d.=1.03), but remained similar for students having middle ($F(1,102)=2.17$ $p=.14$) and high ($F(1,108)=2.96$ $p=.09$) mathematical performance at the beginning of the year (see Figure 3).

Similarly, for students of low mathematical achievement, expectation of success in mathematics decreased significantly across the year ($F(1,77)=14.58$ $p<.001$, T1 mean=4.77 s.d.=1.20, T2 mean=4.34 s.d.=1.05). This was also the case for students of middling achievement ($F(1,102)=6.03$ $p=.016$, T1 mean=5.18 s.d.=0.91, T2 mean=4.90 s.d.=1.16), but expected success remained similar across the year for high-achieving students ($F(1,106)=0.05$ $p=.82$). There was a gender by achievement interaction effect on expected mathematical success ($F(2,285)=3.78$ $p=.024$), where among students of high achievement only, boys had consistently higher expectations for success

(F(1,106)=10.07 p=.002, boys' T1 mean=5.70 s.d.=0.90, boys' T2 mean=5.81 s.d.=0.88, girls' T1 mean=5.38 s.d.=0.74, girls' T2 mean=5.31 s.d.=0.83; see Figure 4).

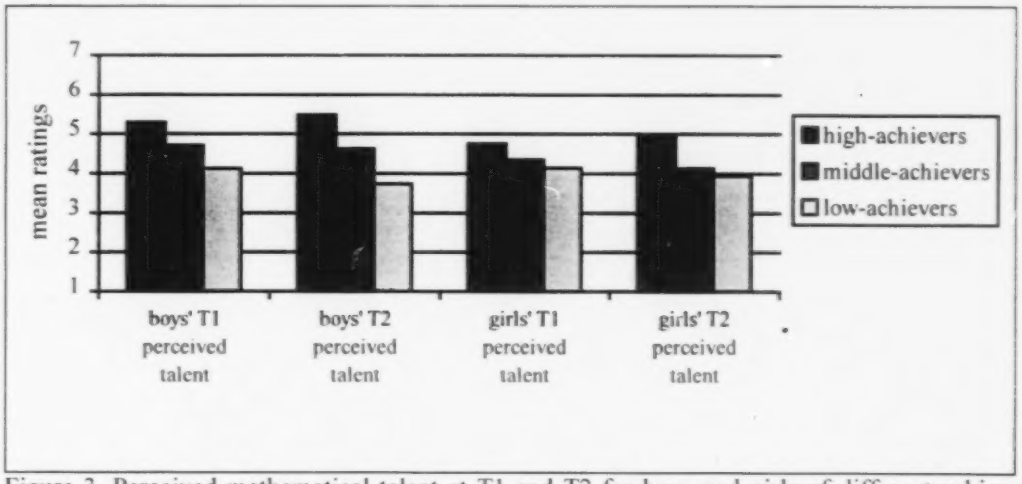

Figure 3. Perceived mathematical talent at T1 and T2 for boys and girls of different achievement levels.

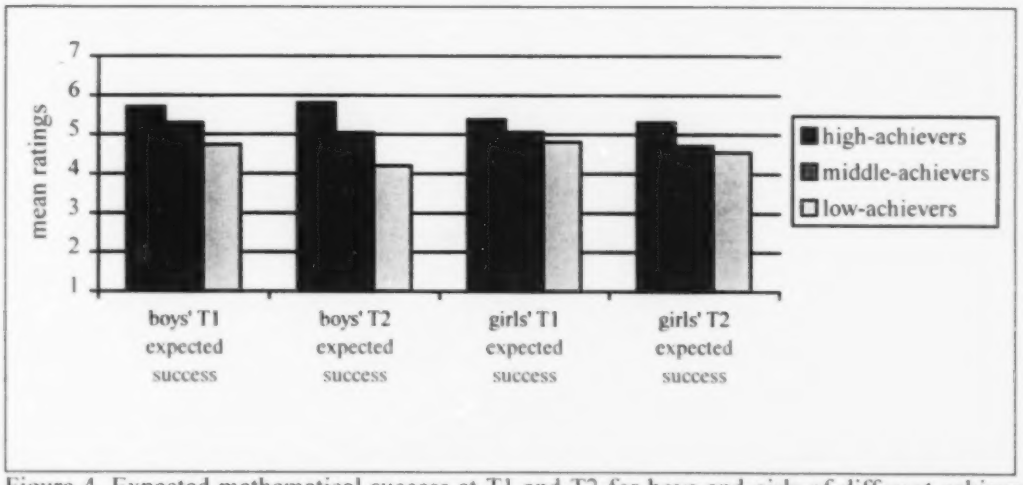

Figure 4. Expected mathematical success at T1 and T2 for boys and girls of different achievement levels.

Students' perceived effort exerted in mathematics decreased significantly over the year ($F(1,296)=54.98$ $p<.001$, T1 mean=5.40 s.d.=10.9, T2 mean=4.79 s.d.=1.40), as shown in Figure 5.

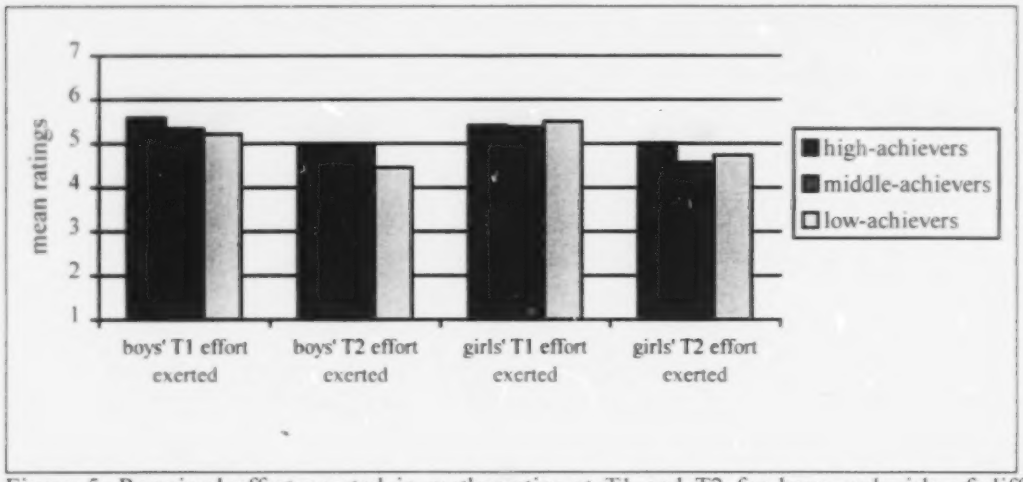

Figure 5. Perceived effort exerted in mathematics at T1 and T2 for boys and girls of different achievement levels.

English. In relation to English, perception of talent was differentiated by achievement level ($F(2,275)=21.40$ $p<.001$), with initially high performers having consistently the highest (T1 mean=4.99, T2 mean=4.98) and low performers the lowest perceptions (T1 mean=4.20, T2 mean=4.11), with middle achievers falling in between (T1 mean=4.60, T2 mean=4.75), as shown in Figure 6.

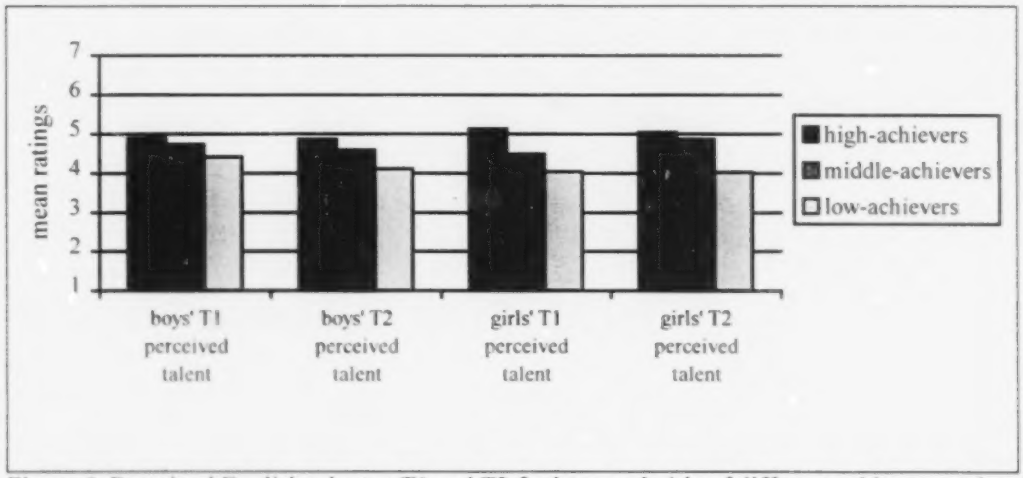

Figure 6. Perceived English talent at T1 and T2 for boys and girls of different achievement levels.

For expectation of success in English, there was a main effect of initial level of achievement ($F(2,284)=16.32$ $p<.001$), with low performing students having the lowest (T1 mean=4.81, T2 mean=4.65) and high performing students the highest expectations (T1 mean=5.52, T2 mean=5.30),

and middle achievers falling in between (T1 mean=5.23, T2 mean=5.21). There was also an interaction effect of gender by time (F(1,284)=4.78 p=.03), explained by the fact that boys' expectations for success decreased significantly over the year (F(1,159)=11.50 p=.001, T1 mean=5.23 s.d.=0.92, T2 mean=4.89 s.d.=1.07), while girls' remained similar (F(1,125)=0.02 p=.88; see Figure 7).

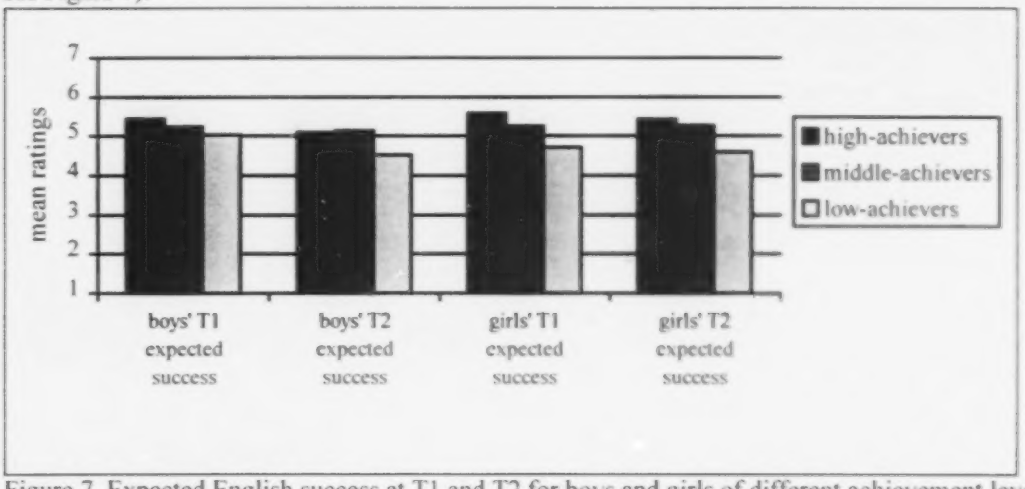

Figure 7. Expected English success at T1 and T2 for boys and girls of different achievement levels.

As in the case of mathematics, students' perceptions of effort expenditure in English decreased significantly across the year (F(1,274)=25.11 p<.001, T1 mean=5.46 s.d.=0.98, T2 mean=5.01 s.d.=1.15), as shown in Figure 8.

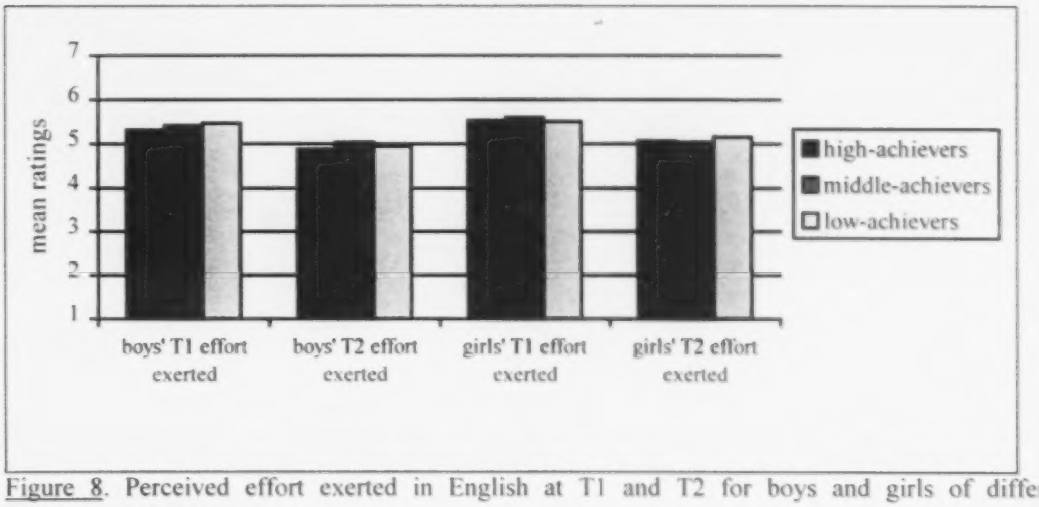

Figure 8. Perceived effort exerted in English at T1 and T2 for boys and girls of different achievement levels.

Student Task-Perceptions

Mathematics. Both middle and high achieving girls' perceptions of the difficulty of mathematics were significantly higher than for their male counterparts (F(1,45)=12.10 p=.001 for

middle-achieving girls, F(1,50)=11.34 p=.001 for high-achieving girls), as indicated by a significant gender by achievement effect (F(2,293)=3.13 p=.045).

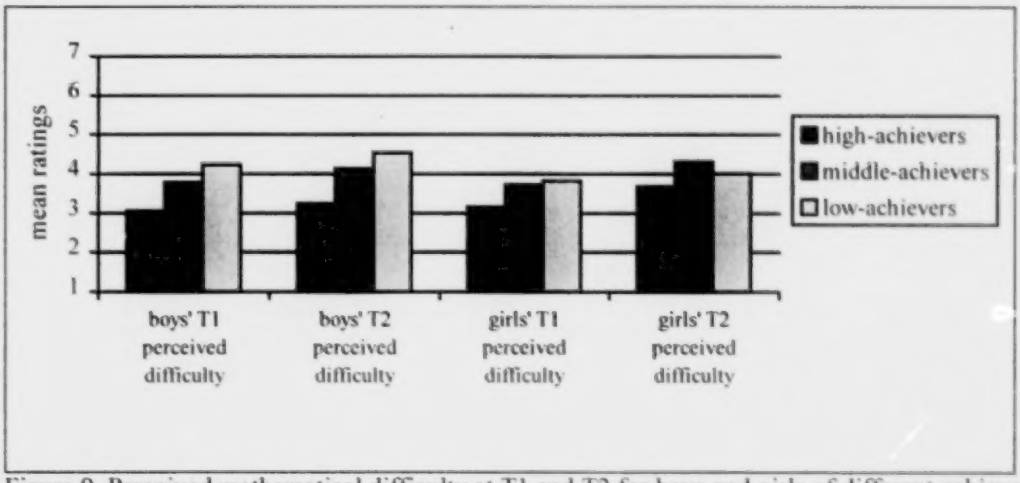

Figure 9. Perceived mathematical difficulty at T1 and T2 for boys and girls of different achievement levels.

The amount of effort required to succeed in mathematics differed by achievement level (F(2,294)=9.47 p<.001), with low achievers having consistently the highest (T1 mean=5.33 s.d.=1.29, T2 mean=5.33 s.d.=1.26) and high achievers the lowest perceptions of effort required (T1 mean=4.85 s.d.=1.35, T2 mean=4.58 s.d.=1.31), with middle achievers falling in between (T1 mean=5.22 s.d.=1.30, T2 mean=5.19 s.d.=1.34; see Figure 10).

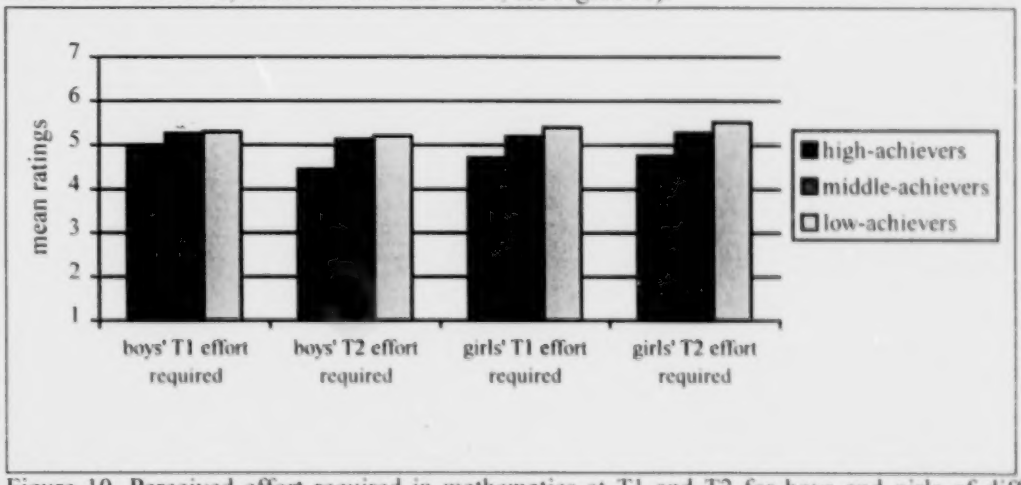

Figure 10. Perceived effort required in mathematics at T1 and T2 for boys and girls of different achievement levels.

English. Boys' perceived English as consistently more difficult than did girls (F(1,295)=11.50 p=.001, boys' T1 mean=3.57 s.d.=1.10, boys' T2 mean=3.71 s.d.=1.13, girls' T1 mean=3.12 s.d.=1.19, girls' T2 mean=3.12 s.d. 1.01). Students' perceptions of the difficulty of

English also differed according to level of achievement ($F(2,295)=30.32$ $p<.001$), with low achievers having consistently the highest (T1 mean=3.95 s.d.=1.14, T2 mean=4.09 s.d.=0.95) and high achievers the lowest perceptions of difficulty (T1 mean=2.88 s.d.=1.02, T2 mean=3.06 s.d.=1.02), with middle achievers falling in between (T1 mean=3.41 s.d.=1.09, T2 mean=3.25 s.d.=1.11; see Figure 11).

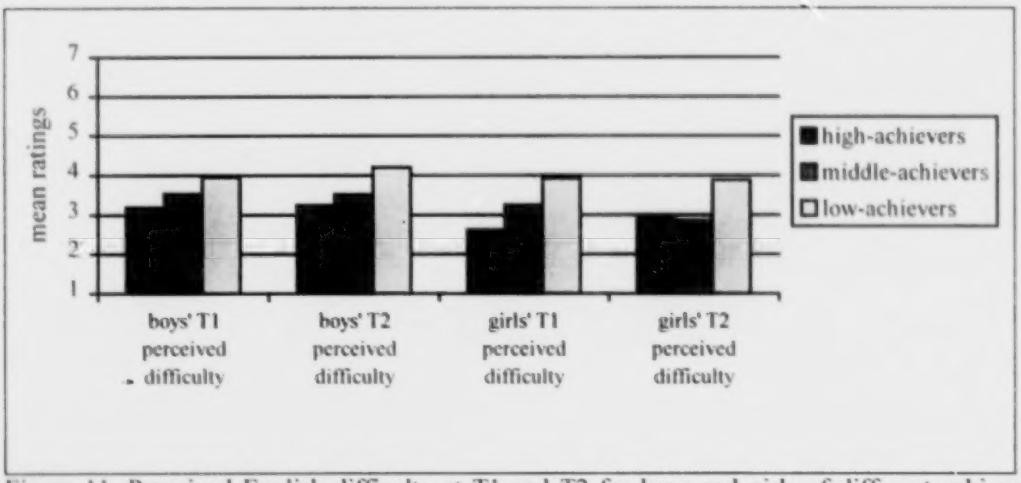

Figure 11. Perceived English difficulty at T1 and T2 for boys and girls of different achievement levels.

Boys of middle and high English achievement perceived the amount of effort needed to succeed as being greater than did their female counterparts ($F(1,89)=4.45$ $p=.038$ for middle achievers, $F(1,104)=12.75$ $p=.001$ for high achievers), as indicated by a gender by achievement interaction effect ($F(2,269)=3.98$ $p=.02$). High-achieving boys rated effort required in English substantially higher than high-achieving girls (boys' T1 mean=4.98 s.d.=1.11, boys T2 mean=4.78 s.d.=1.16, girls' T1 mean=4.20 s.d.=1.33, girls' T2 mean=4.18 s.d.=1.29), and similarly for middle achievers (boys' T1 mean=5.11 s.d.=1.28, boys T2 mean=4.89 s.d.=1.30, girls' T1 mean=4.65 s.d.=1.35, girls' T2 mean=4.37 s.d.=1.38; see Figure 12), whil : among low-achievers, boys' and girls' perceptions of English difficulty were similar.

Student Affect

Mathematics. Students found mathematics less interesting by the end of Year 7 ($F(1,310)=26.08$ $p<.001$, T1 mean=4.05 s.d.=1.66, T2 mean=3.57 s.d.=1.71). In the case of high-achieving students, boys perceived mathematics as being more interesting than did girls ($F(1,114)=7.88$ $p=.006$, boys' T1 mean=4.97 s.d.=1.64, boys' T2 mean=4.54 s.d.=1.69, girls' T1 mean=4.40 s.d.=1.47, girls' T2 mean=3.59 s.d.=1.91), as evidenced by an interaction effect of gender and achievement ($F(2,310)=3.77$ $p=.024$; see Figure 13). Both gender groups had similar interest among low- and mid-achieving mathematics students.

English. As in the case of mathematics, there was also a gender by achievement interaction effect on students' interest in English ($F(2,312)=3.96$ $p=.020$). This was due to girls of middle and high English achievement having consistently greater interest in English than their male counterparts ($F(1,97)=13.27$ $p<.001$ for middle achievers, $F(1,115)=25.65$ $p<.001$ for high achievers; boys' T1

mean=4.18 s.d.=1.53, boys' T2 mean=4.04 s.d.=1.59, girls' T1 mean=4.81 s.d.=1.02, girls' T2 mean=5.23 s.d.=1.10 for middle achievers; boys' T1 mean=4.23 s.d.=1.33, boys' T2 mean=4.06 s.d.=1.63, girls' T1 mean=5.38 s.d.=1.05, girls' T2 mean=5.06 s.d.=1.30 for high achievers; see Figure 14). Among low-achievers however, boys' and girls' interest levels were similar.

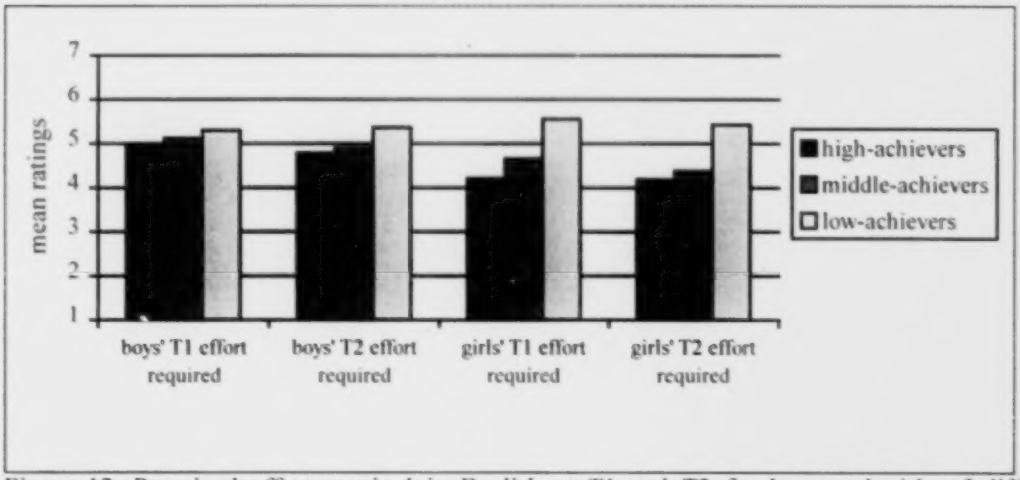

Figure 12. Perceived effort required in English at T1 and T2 for boys and girls of different achievement levels.

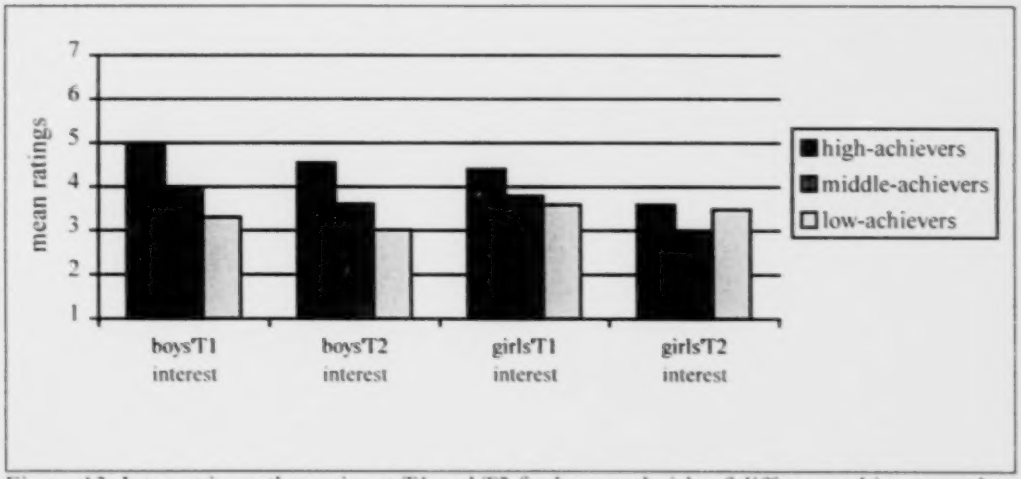

Figure 13. Interest in mathematics at T1 and T2 for boys and girls of different achievement levels.

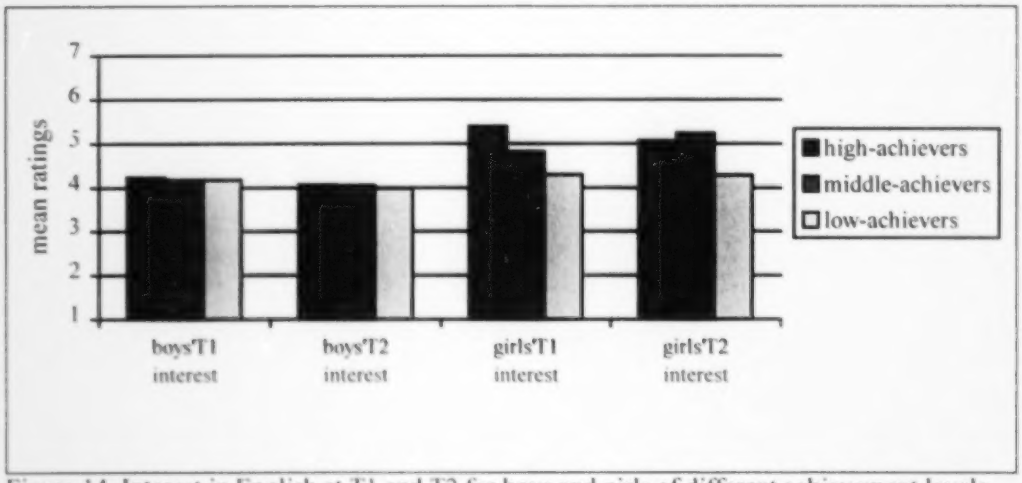

Figure 14. Interest in English at T1 and T2 for boys and girls of different achievement levels.

Student Utility Judgements

Mathematics. By the end of Year 7, students perceived mathematics as less useful than at the beginning of the year ($F(1,289)=8.41$ $p=.004$, T1 mean=6.02 s.d.=1.09, T2 mean=5.82 s.d.=1.25). Students' utility judgements were dependent on level of mathematical achievement ($F(2,289)=4.52$ $p=.012$), with high-achievers consistently perceiving mathematics as most useful (T1 mean=6.30 s.d.=0.78, T2 mean=6.00 s.d.=1.110), followed by middle achievers (T1 mean=6.00 s.d.=1.1, T2 mean=5.75 s.d.=1.19), with low achievers perceiving mathematics as least useful (T1 mean=5.68 s.d.=1.32, T2 mean=5.65 s.d.=1.47; see Figure 15).

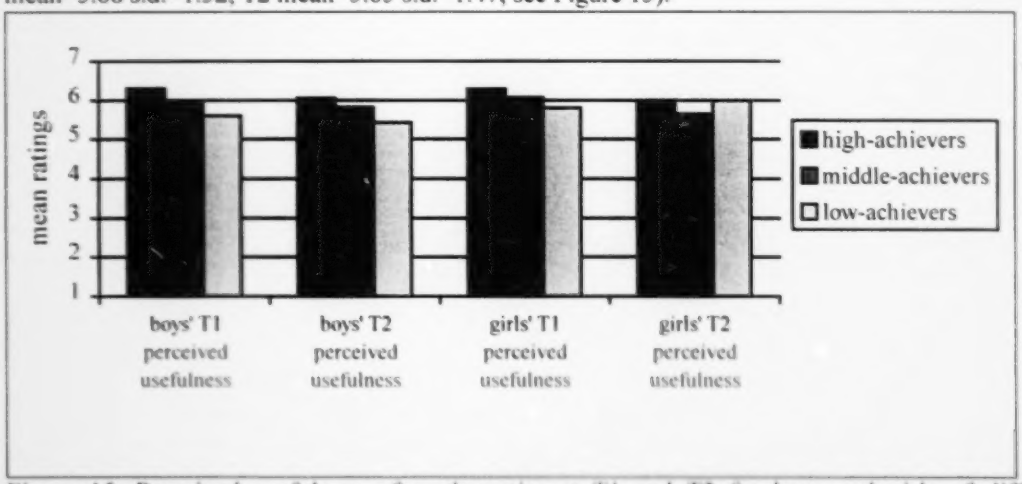

Figure 15. Perceived usefulness of mathematics at T1 and T2 for boys and girls of different achievement levels.

English. Girls consistently rated the usefulness of English higher than did boys ($F(1,264)=5.23$ $p=.023$; boys' T1 mean=5.95 s.d.=1.00, boys' T2 mean=5.58 s.d.=1.41, girls' T1 mean=6.15 s.d.=0.88, girls' T2 mean=6.08 s.d.=1.07), as shown in Figure 16.

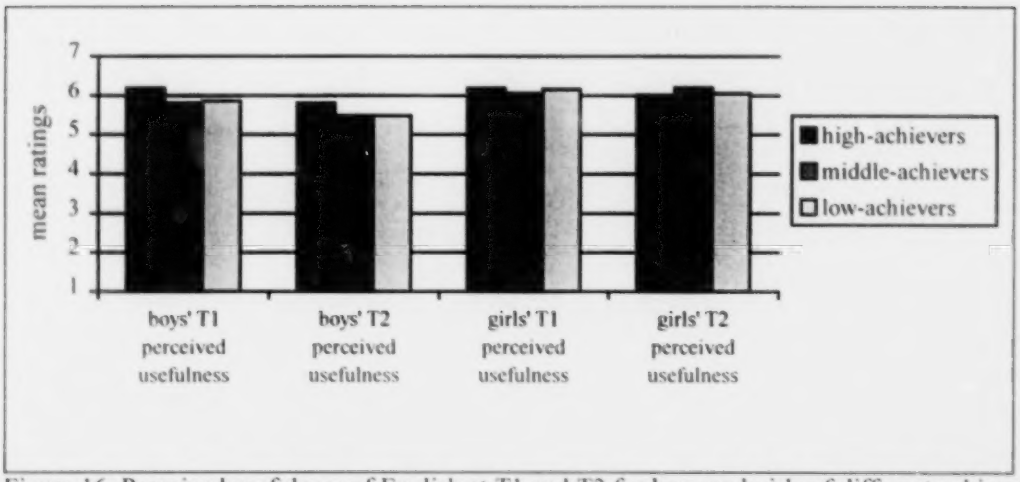

Figure 16. Perceived usefulness of English at T1 and T2 for boys and girls of different achievement levels.

Domain Effects in Student Perceptions

Self-Perceptions. Students perceived their effort exertion in mathematics to be lower than in English at the end of Year 7 ($F(1,275)=10.97$ $p=.001$; mathematics mean=4.79 s.d.=1.40, English mean=5.01 s.d.=1.15). This was the only perception and the only time point at which there were domain effects on student self-perceptions (refer to Figure 8).

Task-Perceptions. For both perceived difficulty and effort required, students consistently gave higher mathematics than English ratings (T1 $F(1,321)=12.23$ $p=.001$; T2 $F(1,276)=39.36$ $p<.001$). This indicates that students consistently found mathematics more difficult than English (T1 mathematics mean=3.61 s.d.=1.18, T1 English mean=3.37 s.d.=1.16; T2 mathematics mean=3.96 s.d.=1.25, T2 English mean=3.45 s.d.=1.12; refer to Figures 9 and 11), and perceived the amount of effort required to succeed in mathematics to be greater than in English (T1 mathematics mean=5.11 s.d.=1.33, T1 English mean=4.92 s.d.=1.30; T2 mathematics mean=5.03 s.d.=1.35, T2 English mean=4.82 s.d.=1.28; refer to Figures 10 and 12).

Affect and Utility Judgements. Students were consistently more interested in English than in mathematics (T1 $F(1,339)=22.79$ $p<.001$; T2 $F(1,289)=46.31$ $p<.001$; T1 mathematics mean=4.05 s.d.=1.66, T1 English mean=4.52 s.d.=1.37; T2 mathematics mean=3.57 s.d.=1.71, T2 English mean=4.38 s.d.=1.52; refer to Figures 13 and 14). Utility judgements however were similar for both mathematics and English (T1 $F(1,290)=.10$ $p=.754$; T2 $F(1,275)=.00$ $p=.970$).

DISCUSSION

As hypothesised, changes in student perceptions over the first year of high school were negative where they occurred. Also as hypothesised, boys had more positive mathematics-related perceptions than girls, and conversely for English, where gender effects were evident. There was no support for the prediction that high achievers would experience the most negative changes in perceptions, and the gender intensification hypothesis had limited support, with only one gender by time interaction occurring in relation to English. An unpredicted interaction of gender and achievement was identified, indicating that high-achieving girls' mathematics-related perceptions and performance were more negative than boys', and that mid- and high-achieving boys' English-related perceptions were more negative than girls'.

Student Performance

Student performance as measured by standardised mathematics and English achievement tests increased slightly from the beginning to the end of Year 7. While this seems a logical result, given that learning should have increased over a year's schooling, it is at odds with research reporting declines in student performance as assessed by school grades post-transition to high school. It is possible that the achievement tests used are dissimilar in content or structure to school assessments, and that school-based measures would have indicated a drop in performance. Other studies have in fact found that decreases in school grades are not reflected in lowered performance on standardised tests (Kavrell & Petersen, 1984; Schulenberg, Asp, & Petersen, 1984). It seems plausible that assessment procedures are sufficiently different in high school from in primary school to produce this discrepancy.

Consistent with the notion of high-achieving students being most negatively affected by the high-school experience, the high achievers suffered a slight decline in mathematical performance, and showed no change in English performance, while both middle and low achieving students' performance improved in both academic domains with the low group showing the greatest improvement. In view of the nature of the Year 7 curriculum, which is largely consolidation of material learned in primary school, it seems plausible that low-achievers' performance should show the largest gains, as the opportunities to further practise and consolidate their existing knowledge continue across the year. There was an unpredicted interaction effect of gender and achievement, however, indicating that high-achieving girls perform slightly less well than their male counterparts. This is consistent with the body of research documenting gendered performance differences among high-achieving mathematics students (eg Feingold, 1993; Benbow & Stanley, 1980). Conversely, and not just among high-achieving students, girls consistently outperformed boys on English tests. This finding is supported by a body of research showing superior English performance by girls (eg Skaalvik & Rankin, 1994; Halpern, 1986).

Declining Student Perceptions Across the first Year of High School

One English-related and three mathematics-related perceptions declined over the first year of high school. By the end of Year 7, students reported exerting less effort in both English and mathematics, being less interested in mathematics, and perceiving mathematics as less useful than at the beginning of the year.

Other negative changes occurred on both English and mathematics-related perceptions, but only for specific subgroups of students. For boys only, expected success in English decreased over the year,

while girls' success expectations remained stable. Expected mathematics success declined for students of middle and low mathematics achievement only, remaining constant for high-achievers. Also, for students having the lowest level of mathematical performance, perception of talent decreased from the beginning to the end of the year, but did not change for mid- and high-mathematics achievers. Clearly, high school experiences impact negatively upon certain student perceptions, and differentially for different subgroups of students.

Evidence of Sex-Typed Patterns of Perceptions

It was anticipated that boys would have more positive mathematics-related perceptions than girls, and that the converse would apply to English. This hypothesis had partial support, in that boys had higher perceptions of mathematical talent than girls, consistent with recent Australian research focusing on perception of talent (Bornholt, Goodnow, & Cooney, 1994; Watt, 1995). Conversely, girls had more positive English-related perceptions than boys, in that they found English less difficult, and perceived it as having greater utility value.

Achievement-Level as a Determinant of Attitudinal Adjustment

It has been found that high-ability students are most negatively affected by the transition to high-school (Wigfield *et al.*, 1991), with streaming practices leading to homogeneous reference groups being suggested as a probable explanation. Despite the fact that students in the present study were largely unstreamed, however, two achievement by time interactions were identified for expected success and perceived talent in relation to mathematics. These interaction effects were not due to high-achievers being most negatively affected over the year, but were in fact due to lower achieving students exhibiting negative changes. The Australian context, in which students in the first year of high school are rarely streamed, makes it unlikely that American findings will be replicated. It is certainly deserving of further study to determine reasons for why Australian students might display discrepant attitudinal adjustment from American students. Certainly the lack of streaming is one clear difference, which may account for why high-achieving students are not most negatively affected over Year 7. The longitudinal study, of which these students are a part, will seek to identify if streaming practices introduced in the following year (Year 8) produce such change.

Gender Intensification

There was limited evidence of gender intensification, occurring only for expectation of success in English, whereby boys became more negative in their perceptions, while girls' perceptions remained similar. It was not the case that girls became more negative than boys in their attitudes to mathematics, supporting the findings of Wigfield and colleagues (Wigfield *et al.*, 1991). It may be, as Wigfield and colleagues suggest, that mathematics is no longer perceived as a male domain (1991), and this could explain why there is evidence of gender intensification for English and not mathematics, assuming English is still perceived as a female domain. Other data from the study, not presented here, do indicate evidence of sex-typing in both mathematics and English, with effect sizes being slightly stronger for English than for mathematics. These data are consistent with the suggestion above.

Gender and Achievement Interaction Effects

Unpredicted interaction effects between gender and achievement occurred for both mathematics and English-related perceptions. For mathematics, high-achieving girls had lower interest and success expectations than their male counterparts. Middle and high-achieving girls also regarded mathematics as more difficult than their male counterparts. It is possible these girls may be more

susceptible than other girls to negative effects, since they are high-achievers in what may be stereotyped as a male domain. For English, girls of middle and high achievement had more positive perceptions than their male counterparts on both interest and effort required to succeed in English. Again, it may be that these boys are more susceptible than other boys to negative effects, since they are achieving in what is often stereotyped as a female domain.

Domain Effects

There is ample evidence of domain-specific patterns of effects. Apart from different effects on students' mathematics and English-related perceptions reported above, direct comparisons of students' mathematics and English-related perceptions reveal significant differences. Students reported more positive perceptions for English than for mathematics, with students exerting more effort in English, and perceiving English as less difficult, requiring less effort to succeed, and as being more interesting. Clearly it is important to study different academic domains separately, since patterns of effects are largely domain-specific, while reported perceptions differ according to academic domain.

Conclusion

The major contribution of this study lies in its examination of the impact of time in Year 7 and student characteristics on a range of mathematics and English-related perceptions. Previous studies have not addressed the range of variables that this study has, involving self-perceptions, task-perceptions, affect and utility judgements. By including these additional dimensions of students' mathematics-related perceptions, the present study has been able to identify which are negatively affected over the first year of high school and which remain stable. Moreover, differential changes in perceptions for students of varying levels of achievement were able to be identified across this range of perceptions, showing that such change does not occur on many areas of student-related perceptions.

Academic domain emerged as a defining feature of susceptibility to change or stability of student perceptions. There was greater stability for English- than for mathematics-related perceptions (English perceived talent, difficulty, effort required, affect and utility-value, as opposed to only effort required in mathematics remaining stable), which may be a reflection of the greater curriculum consistency from primary to secondary school in English than in mathematics. Conversely, mathematics-related perceptions were most susceptible to change, with mathematical performance, perceived effort exerted, affect and utility judgements exhibiting change over the year for all students, as opposed to there being only consistent changes in perceived effort exerted for English. Changes were negative in nature in all instances excepting performance, reflecting previous research which has examined the impact of beginning high-school.

Students' level of achievement was also related to the stability of their perceptions, with high-achieving students having the greatest stability in their perceptions, and low-achieving students the least.

Finally, the effects of Year 7 experience are captured through the design. All students are in similar school settings and in the same grade level for the duration of the study. Hence, there is no confounding of changes in grade level with changes experienced through commencing high school. This has been an acknowledged weakness of research into the impact of transition to high school (eg: Anderman & Midgley, 1997; Harter, Whitesell, & Kowalski, 1992). Some studies have

circumvented this problem by obtaining beginning and end of year measures in both the final primary and initial high school years (eg: Wigfield *et al.*, 1991), but these typically have addressed a limited number of perceptions.

In summary, the study has identified changes on a range of student perceptions and performance across Year 7, as well as the effects of gender and level of achievement on these. The idea of gender intensification (Hill & Lynch, 1983) was tested across a range of perceptions, but was generally not supported. The notion of most able students being most negatively affected over time could similarly be tested across these perceptions, but was not supported. In fact, the present study identified lower achieving students as being most negatively affected over Year 7, which is probably related to Australian practices of not streaming students in their first year of high-school. The longitudinal study from which these data are drawn will allow the effects of streaming from other factors to be teased out as these students proceed through high-school.

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